



# A NEW GENERATION OF EXPEDITIONARY EARTH-FILLED PROTECTIVE BARRIERS

*By Warrant Officer 2 Matt A. Graves*

**F**irst there were sandbags, then came gabion baskets, and now a new element in field fortifications is emerging that could give sappers an enhanced, multifaceted capability for force protection. Since deploying to the Balkans more than 15 years ago, the Corps of Royal Engineers has become increasingly involved with the construction of static physical force protection in the form of blast walls, protective berms, *sangars* (fortified observation posts), and explosive ordnance disposal (EOD) protective works. We also continue to assist with infrastructure construction such as building roads, culverts, and flood protection measures.

DefenCell is a relatively new military innovation that will provide additional options when undertaking all of these tasks. It has been successfully used in Afghanistan by the British Army's 39 Engineer Regiment (Air Support) to construct protective berms and ground stabilization structures at several locations and at the Defence Explosive Ordnance

Disposal School in Britain to improve its EOD training area. DefenCell is a geotextile polymer structure that has great strength, not just because of the textile's properties, but because of the cellular form of each unit. The cells confine the fill material and give it such load-bearing strength that it can be driven on or even compacted with heavy rollers. This in turn enhances its ballistic protection properties and aids the stability of the structures. Walls of substantial heights can be achieved by field engineers, and DefenCell engineers can help in the design of even higher structures.

## **Afghanistan Case Study**

**T**he 39 Engineer Regiment (Air Support) began construction of ammunition supply points (ASPs) that could securely contain large amounts of ordnance ranging from air-dropped weapons to trip flares. Among their goals, the engineers sought to—

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>DEC 2008</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2008 to 00-00-2008</b>	
4. TITLE AND SUBTITLE <b>A New Generation of Expeditionary Earth-Filled Protective Barriers</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army Engineer School,14010 MSCoE Loop BLDG 3201, Suite 2661,Fort Leonard Wood ,MO,65473-8702</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT  <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES  <b>3</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

- Eliminate the huge footprint a standard earthen berm would require.
- Reduce the logistical burden presented by a construction of this size.
- Develop a “metal-free” solution to reduce the danger of secondary fragmentation from possible explosions.

The higher headquarters of 39 Engineer Regiment (Air Support), 12 Engineer Brigade, approached Terram Ltd., a sister company of the U.S. firm Fiberweb™, because of the company’s expertise in constructing geotextile cell berms for the oil and gas industry. Terram Ltd. provided a design that fulfilled all the requirements and, within four weeks of being contracted, manufactured the geotextile cells required to construct the berms for both ASPs and delivered 20 kilometers of geotextile cells. The reduction in the logistical requirement over alternate systems was a huge benefit when supplies had to travel thousands of miles, including passage through the Khyber Pass. And for Soldiers and commanders alike, the reduction of even one vehicle in a convoy is a real morale booster.

During the project, more than 16 kilometers of geotextile cells were laid until the required height was achieved. Approximately 20,000 cubic meters of sand were used to fill the cells, which were then compacted using plate compactors and heavy rollers. As the berms gained height, a crane lifted rollers atop the cells to allow compaction of the upper layers, adding to the stability and longevity of the design. A patented stacking system allows strong vertical walls to be constructed.

This means that standard blast walls and compartments can be constructed, providing a realistic alternative to existing systems for the first time. This innovative product is emerging as a new generation in force protection systems that can provide additional capabilities or complement existing systems.

Comprehensive blast tests showed superior protection and revealed the design’s ability to sustain damage to the outer cells while still retaining structural integrity overall. During these trials, another significant benefit of the cellular design was tested: its ability to sustain damage to the outer cells of a barrier while still retaining structural integrity overall. As a result of these tests, DefenCell has been specified as a barrier system for a number of security applications. As a ground stabilization product DefenCell is supplied in cells of two different sizes. In wet or unstable conditions, the cells are simply deployed, filled, and compacted to provide vehicle hardstand areas. Helicopter landing areas can also be established, with stabilizers added to the fill materials to prevent dust and downdraft erosion.

### Additional Benefits

**A** key benefit of the DefenCell system is that it is very lightweight, nonmetallic, and compact. The individual units can be easily cut to shape and size and could be split down and readily man-packed. The system is packed on standard North Atlantic Treaty Organization (NATO) pallets and is readily air-droppable. The geotextile polymer has an ultraviolet (UV)-resistant additive, and barriers can be



**DefenCell units form a protective barrier around a container.**





**An ammunition supply point is constructed from DefenCell units.**

painted to suit local conditions or can be specially treated to meet specific requirements.

The deconstruction and disposal of temporary or semipermanent sites that the Corps constructed over the years has become a major issue recently. The large number of blast walls and other structures create a huge ecological problem and represent a vast amount of metal and other materials to dispose of. Because DefenCell units contain no metal, they are very easily dismantled and the geotextile material can be reused by the local population in civil engineering projects such as the construction of roads.

### Summary

**D**efenCell is an innovative wall, barrier, and ground stabilization system that can provide a complement or alternative to current force protection resources while providing some significant additional benefits:

- Reduction of logistical footprint by more than 40 percent, which maximizes transport in-loads, reduces hazardous convoys, and cuts costs.
- Lightweight and air-droppable.
- Reduction of secondary fragmentation risk.
- Ease of dismantling in an environmentally sympathetic fashion.
- Simplicity of quickly building strong, load-bearing structures.
- Durability due to built-in UV protection.
- Ability to absorb damage while retaining structural integrity.
- Blast resistant.

More information on DefenCell can be found at [www.defencell.com](http://www.defencell.com).



*Warrant Officer 2 Graves serves in the Royal Engineers (RE), British Army. He began his career as a combat engineer and has deployed to Northern Ireland, Belize, Cyprus, Kenya, the Falkland Islands, and South Georgia in the Antarctic. He has deployed twice to the Balkans as part of the Mine Awareness Training Team. As a bomb disposal officer in 33 Engineer Regiment (EOD), he conducted EOD operations in the United Kingdom, Sierra Leone, and Kenya. He was selected in 2005 as sergeant major of 37 Armoured Engineer Squadron in Germany and deployed to Iraq on Operation Telic. WO2 Graves holds a master's in business administration and has completed more than 22 years service with the British Army.*

### References and Acknowledgments

Lieutenant Colonel S. Browse, RE, Presentation to the Defence IQ Combat Engineering Conference, Café Royal, London, 31 October 2007.

Captain P. Hammett, RE, Presentation to the British Construction Industry Awards 2007, London, 10 October 2007.

Joint Force Engineer, 29 (Land Support) Engineer Group, "Operation Herrick, Afghanistan," *Sapper Magazine*, September 2006.

"Force Protection Engineering, Part 1—Fundamentals," *Military Engineering*, Volume IX, Army Code No 71838, Ministry of Defence, January 2007.

"Field Engineering, Pamphlet No 2—Field Fortifications," *Military Engineering*, Volume II, Army Code No: 71747, Ministry of Defence, November 2006.

DefenCell technical information provided by Terram Ltd ([www.terram.com](http://www.terram.com)).

DefenCell sales information provided by J & S Franklin Ltd ([www.franklin.co.uk](http://www.franklin.co.uk)).